**SIMPSON BASIN**

**Links**

Tenements (PDF; contains a link to the DSD website for the latest information)

**Summary**

- **Age**: Triassic.
- **Area in South Australia**: ~50,000 km² (~19,300 sq. miles).
- **Depth to target zones**: 2000–2600 m.
- **Thickness**: Up to 300 m.
- **Hydrocarbon shows**: Peera Peera Formation (shows in 5 wells).
- **First commercial discovery**: None.
- **Identified reserves**: Nil.
- **Undiscovered resources (50% prob.)**: Not determined.
- **Production**: Nil.
- **Basin type**: Intracratonic.
- **Depositional setting**: Non-marine.
- **Reservoirs**: Meandering fluvial sandstone.
- **Regional structure**: N–S faulted anticlines in sag basin.
- **Seals**: Lacustrine and overbank sediments.
- **Source rocks**: Underlying Pedirka Basin siltstone and shale; Peera Peera Formation siltstone and shale.
- **Depth to oil/gas window**: 1250 m (oil).
- **Number of wells**: 6.
- **Seismic line km**: 7228 2D.

**Structural setting**

The Simpson Basin extends over ~100,000 km² in South Australia and the Northern Territory (approximately half lies in South Australia). It is a circular, poorly defined depression with one major depocentre, the Poolowanna Trough (Fig. 1). The basin overlies Palaeozoic and older basins and is overlain by the Eromanga Basin (Jurassic to Cretaceous; Figs 2, 3).

During the Triassic, the western Pedirka Basin area remained elevated and was eroded, while the eastern portion subsided to form a depocentre, the Poolowanna Trough. Regional uplift and erosion terminated deposition in the Simpson Basin at the end of the Early to Middle Triassic. The main episode of structuring occurred in the Early Tertiary, when E–W compression produced major meridional faulted anticlines.
Exploration history
A seismic survey in 1971 revealed an eastward thickening sediment package between the eastern Pedirka Basin and the Eromanga Basin. The postulated Triassic age for these sediments was confirmed when Poolowanna 1 recovered oil from this sequence in 1977. Six petroleum wells have penetrated the basin and over 11 000 km of seismic acquired in the 1970s and 1980s by Delhi–Santos (Fig. 1). The area was relinquished in 1989–90. A number of licence applications are current.

Stratigraphy
The Simpson Basin contains Early to Middle Triassic Walkandi Formation overlain conformably by Late Triassic Peera Peera Formation (Fig. 3). Walkandi Formation is restricted to the Poolowanna Trough depocentre. The Peera Peera Formation extends westwards and onlaps the Dalhousie–McDills Ridge and eastwards where it onlaps the Birdsville Track Ridge.

Walkandi Formation consists of interbedded shale, siltstone and minor sandstone redbeds deposited in a shallow ephemeral lacustrine environment. The unit correlates with the Tinchoo Formation of the Cooper Basin to the east. Peera Peera Formation consists of grey shale and siltstone at the base with minor thin sandstone and coal, a fining upward sandy middle unit and a black, silty highly carbonaceous shale at the top — reflecting deposition on a floodplain crossed by meandering fluvial streams with lacustrine development. It is correlated with the Cuddapan Formation of the Cooper Basin region.

Source rocks
The oxidised nature of the Walkandi Formation redbeds downgrades source potential. However, the overlying Peera Peera Formation is rich in organic matter (TOC up to 5%) and should be oil mature in the Poolowanna Trough. The Peera Peera Formation is considered to be gas-prone with modest oil yields.

Reservoirs and seals
Limited drilling indicates that sandstone interbeds in the Walkandi Formation are fine grained, with low porosity and permeability. The Peera Peera Formation also suffers from laterally variable, poor quality reservoirs (maximum measured porosity 7.8%). Reservoir quality is thought to improve updip from the Poolowanna Trough.

Seals consist of intraformational siltstone and shale of the Walkandi and Peera Peera formations.

Traps
Potential trapping mechanisms are dominantly structural (faulted anticlines).

Undiscovered resources
There is no estimate of undiscovered resources.

Current projects
There are no current projects.

Exploration access
The Simpson Basin is overlain by the Simpson Desert Regional Reserve where exploration is permitted (Fig. 1, Environment in the ‘Land access’ section of this USB), and the Simpson Desert Conservation Park where exploration is not permitted (Fig. 1).
**Licence status**

Four PELs were granted to Senex Energy Ltd, in June 2013. Licence activity in the previous year is discussed in the 'Exploration and development' section of this USB, and Figure 4 shows the licence status at the time of publication. Use this link for further information on holders of petroleum tenements in South Australia.

**Key references**


FIGURES
1. Eromanga Basin and infrabasins, South Australia. Wells and seismic lines. (204548-056)
2. Schematic section across the Eromanga, Pedirka and Simpson basins. (204548-057)
3. Geological summary of the Arckaringa, Pedirka and Simpson basins. (204548-025)
4. Eromanga Basin and infrabasins, South Australia. Petroleum and geothermal tenements. (204548-0062)
Figure 2  Schematic section across the Eromanga, Pedirka and Simpson basins.
<table>
<thead>
<tr>
<th>AGE</th>
<th>ROCK UNIT</th>
<th>LITHOLOGY</th>
<th>DEPOSITIONAL ENVIRONMENT</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid-Late</td>
<td>ALGEBUCKINA SANDSTONE</td>
<td>Braided fluvial</td>
<td>Reservoirs rely on overlying marine shale seal. Small anticlinal traps requiring close seismic grid. Intraformational seals rare.</td>
<td></td>
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<tr>
<td></td>
<td>POOLOWANNA FORMATION</td>
<td>Meandering or anastomosing fluvial, minor associated floodplain deposits.</td>
<td>Uneconomic oil in Poolowanna 1</td>
<td></td>
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<tr>
<td>Late</td>
<td>EROMANGA BASIN</td>
<td>Lacustrine and low energy, meandering fluvial.</td>
<td>Thickness and extent strongly structurally controlled requiring close seismic coverage. Variable quality, discontinuous reservoirs.</td>
<td></td>
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<tr>
<td>Middle</td>
<td>PEERA PEERA FORMATION</td>
<td>Shallow, ephemeral lacustrine.</td>
<td>Tight, potential seal to underlying Permian where present. Possible local reservoir development as for Arrabury Formation. (See Cooper Basin)</td>
<td></td>
</tr>
<tr>
<td>Early</td>
<td>WALKANDI FORMATION</td>
<td>Lacustrine, meandering fluvial and back swamp.</td>
<td>Fair + good gas - and oil - prone source rocks, thermally mature for oil generation. Stuart Range Formation could provide excellent seal.</td>
<td></td>
</tr>
<tr>
<td>Late</td>
<td>SIMPSON BASIN</td>
<td>Marginal marine.</td>
<td>Reservoir sands may be developed in Crown Point and Boorthanna Formations</td>
<td></td>
</tr>
<tr>
<td>Early</td>
<td>PURNI FORMATION</td>
<td>Shallow marine-fluvial periglacial.</td>
<td>Flat to steeply dipping. Locally highly structured.</td>
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<tr>
<td>Late</td>
<td>CROWN POINT FORMATION</td>
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<tr>
<td>Late</td>
<td>BOORTHANNA FORMATION</td>
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<tr>
<td>Late</td>
<td>MT TOONDINA FORMATION</td>
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<tr>
<td>Late</td>
<td>UNDIFFERENTIATED WARBURTON, OFFICER AND AMADEUS BASIN SEDIMENTS</td>
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Figure 3 Geological summary of the Arckaringa, Pedirka and Simpson basins.